

Economics Education and Research Consortium

Working Paper Series

ISSN 1561-2422



No 04/02

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This project (01-128) was supported
by the Economics Education and Research Consortium

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Research area: **Public Economics**

Can Government Paternalism Prevent Credit Market Failure?*

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December 23, 2003

Abstract

This paper investigates how the possibility of government subsidies to firms affects lending and managerial incentives. We develop a model that shows that government support can perform as implicit insurer of firms, which leads to two main effects: lowering incentives of managers and increase of incentives to finance. The equilibrium with government intervention can be more efficient than one without intervention. We test the model predictions on Russian enterprise-level panel data for 1996-2000. Empirical evidence supports two predictions: 1) the probability that a firm gets external financing increases with increase of government's care about firms' survival; 2) firms with intermediate performance get subsidies.

1 Introduction

The economic decline in Russia in 1990s was one of the deepest and longest among all transition economies. Different explanations for this observation have been proposed: the size of the economy, the high level of intervention of the government in the economy, inability to compete with the increased flow of import, and lack of human capital due to inefficient mechanisms of central planning. As a result of distorting planning most enterprises needed costly restructuring to survive in the market economy, but only a small part of the economy had the necessary internal financing. Moreover, managers of enterprises that had financing did not always have incentives to restructure due to moral hazard. In such a situation external financing was hardly profitable for lenders. Thus, prospects of restructuring faced two primary problems – lack of managerial incentives and lack of access to capital.

The government played an important role in weakening the managerial incentives in transition. If the government had pursued bankruptcy of all loss-making enterprises instead of bailing them out, a significant part of the economy would have had to be liquidated. Liquidation of a firm has both economical and political costs for the government, since, on the one hand, firms pay taxes, and on the other hand, unemployment growth destroys the electorate support. Shleifer and Vishny (1994) considered bargaining between firms and

*We thank Eric Berglof, Irina Denisova, Maria Goltsman, Sergey Guriev, Luoia Hu, Marcin Peski, Maria Ponomareva, Rob Porter, Judith Thornton, Ksenia Yudaeva and Ekaterina Zhuravskaya, and the participants of the CEPR-WDI 2003 Transition Conference for useful comments and discussions. Financial support from Economics Education and Research Consortium is gratefully acknowledged.

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the government for extra employment in exchange for transfers. While these transfers allow inefficient firms to survive, the society pays for political benefits of the government.

Government's benefits of bailing out lead to lower firms' incentives, as they anticipate bail out. Kornai (1980) was the first to draw attention to the phenomenon of expected bail out and called it as the problem of the "soft budget constraints" (SBC). The solution for SBC problem is not simple. Ex-ante hardening of government financial policy can even worsen the situation. Perotti (1998) developed the model, illustrating how political goals of the government lead to failure of any attempts to reform the economy by ex-ante tightening financial policy. Failure occurs because the situation "too many to fail" leads to low probability of ex-post liquidation of a particular firm and fewer firms undertake costly restructuring in the case of ex-ante tight financial policy. In particular, this model explains the failure of tightening financial policy in Russia in 1992.

Government subsidies could perform not only as a source of protection of firms from liquidation, but also as an investment tool to restructure firms. However, the level of subsidies fell dramatically during transition¹ and, besides, the distribution of subsidies could be influenced by political factors.²

An alternative source of external financing (the main in normal situations) is bank lending. A large number of banks appeared in Russia at the beginning of the transition.³ Banks could promote managerial incentives, as firms had to send a good signal to acquire a loan in a bank and produce enough cash to serve the debt. Russian banks, however, were very passive in lending. Domestic credit to the economy was at the level of only 12.7% of GDP in 1998, in contrast to significantly higher levels of credit in other transition economies⁴: the matter is that Russian banks used available funds mainly to operate on the government bond market. An explanation for such a low level of credit in Russia could be that firms had low credibility in the eyes of banks, and they were likely to default on their debt. Actually, unstable macroeconomic situation and uncontrolled financial pyramids schemes lead to dramatic increase of interest rate, and only risky projects could have allowed firms to repay taken loans. According to the classical theory of Stiglitz and Weiss (1981), this leads to credit rationing. There are examples from other transition economies, which provide evidence for poor performance of bank loans. For instance, as Bonin and Huang (2001) discuss, banks in China, which are state-owned, were directed to lend to state-owned enterprises and, as a result, the estimated proportion of non-performing loans was about 29% of all loans in 1998.

Besides the problem of liquidity, the firms faced the so-called commitment problem, widely discussed in the literature. Hart and Moore (1989) show that, due to firms' inability to commit to long-term profit, efficient projects may not be financed.⁵ Banks also could face the commitment problem. Dewatripont and Maskin (1995) consider a model in which both the government and banks can create SBC for a firm. In their analysis ex-post rationality of the lender destroys credibility of her commitment not to bail out and the firms are subject to SBC. Mitchell (1993) considers an alternative way for creating SBC by banks – strategic

¹See Roland (2000) for the discussion.

²Orlov, Paltseva and Zhuravskaya (2000) use enterprise-level data for 1996-1998 to provide empirical evidence that government subsidies in Russia were mainly distributed not with the purpose of firms' restructuring, but according to short-term political reasons.

³There were 1360 banks in 1992 and 1713 banks in 1993 (World Bank, 1993).

⁴60.1% of GDP in Czech Republic, 32.5% in Slovenia, 22.8% in Hungary and 20.6% in Poland in 1998.

⁵The paper is widely discussed in Hart (1995).

creditor passivity, a situation, in which lenders have incentives to hide the information about bad loans from the public.⁶ Other possible explanations for low bank lending include low bank reserves,⁷ low experience of Russian bankers in risky lending, and large risks of investment into Russian real sector caused by large monitoring and enforcement costs.

Thus, due to several problems, banks may have avoided lending to the real sector in Russia. The government's incentives to bail out firms could help firms to serve debt, and to make lending more attractive. These incentives, however, have costs - soft budget constraints. In this paper, we look at one of the sources of inefficient under-financing - the problem of lack of firms' commitment to serve debt, and study a trade-off between tight government policy and financing. We develop a model close to one by Hart and Moore (1989), but introduce a government that can bail out defaulted firms. First, we show that in the framework of the original Hart and Moore's model the higher the government's care about firms the closer the solution to the first-best. We then develop the model and show that social welfare depends on paternalism non-monotonously due to soft budget constraints. Low level of paternalism, however, still improves the situation and the second-best is reached with non-zero subsidization.

Our model predicts that a government caring only about expected net tax collection finances only firms with medium performance, and among those firms, which are granted with subsidies, more efficient firms receive relatively lower subsidies. The model also predicts that the higher the government valuation of the future leads to higher level of investment. We use a unique database on Russian firms' balance sheets for 1996-2000 to perform empirical tests of these predictions. To account for sample selection in subsidization and unobserved heterogeneity we employ semi-parametric estimation method for panel data sample selection models developed by Kyriazidou (1997). The results of estimation show that the government have smaller propensity to subsidize very efficient and very inefficient firms, and that outside financing of firms is higher in more protective regions.

The paper is organized as follows. Section 2 presents a basic model of incomplete short-term contracts with no dependence of production on efforts. In section 3 we consider interaction of the commitment problem and the problem of SBC caused by implicit insurance of firms by the government. Testable hypotheses, data and empirical methodology are described in section 4. Section 5 presents the results of empirical testing. Section 6 concludes.

2 Basic model

2.1 Setup

We consider a two-period model with players of three types: a set of firms, competitive lenders, and a government. There is a continuum of firms. Each firm is run by a risk-neutral manager that has an investment project yielding y_1 in $t = 1$ and y_2 in $t = 2$,⁸ where the returns are different across firms and are

⁶For complete survey of theory of SBC see Berglof and Roland (1998), Maskin and Xu (2001), Mitchell (2000).

⁷In spite of the low level of living standards, the aggregate savings of Russian households are estimated up to 20 billion dollars, but these savings are stored in "socks" due to the low confidence to banks.

⁸In this paper we address a firm and a manager interchangeably.

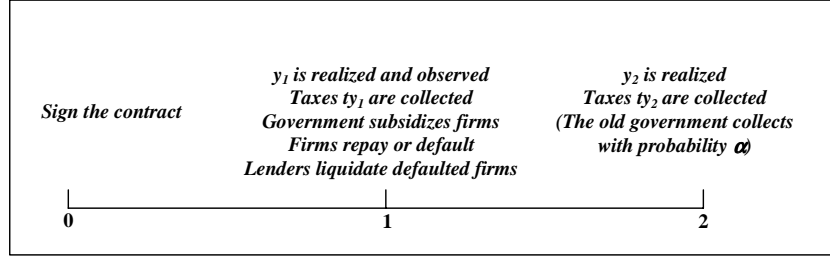


Figure 1: The time-line of the basic model

distributed according to atomless cdf $F(y_1, y_2)$. The returns are certain and do not depend on effort; there is no investment opportunity in $t = 1$. Each manager has initially no own cash and needs investment in the amount of K to run the project (*the same for all the projects*). For simplicity we assume that physical assets value nothing and consequently liquidation value of each project is zero both in $t = 1$ and in $t = 2$.

The lenders are cash unconstrained. They can sign contracts with any firm. Following Hart and Moore (1989) we assume that the firms can freely divert returns from the lenders, and consequently they have no incentives to repay in $t = 2$. The lenders specify in the contracts the value of loan I and the repayment P paid in period 1. The lender can make take-it-or-leave-it offer to the borrower in the case of default.⁹ Traditionally, net interest rate and discount rate of borrowers and lenders are normalized to zero.

Finally, consider a government that keeps the power with certainty in $t = 1$ and with exogenous probability α in $t = 2$. It has no assets in $t = 0$ and collects taxes from all the returns. Tax rate is exogenous and equals t . Tax payments are enforceable.¹⁰ This assumption is crucial, as creates incentives for bail out of firms by the government. The government can subsidize firms, more exactly it can verifiably pay to the lenders and reduce the debt of a borrower, but alike the firms, it cannot bargain for reduction of debt. We consider a net revenue maximizing government and its problem is

$$\begin{aligned}
 U_G &= (T_1 - S_1) + \alpha(T_2 - S_2) \rightarrow \max \\
 \text{s.t. } &S_1 \leq T_1,
 \end{aligned} \tag{1}$$

where T_t , S_t are total taxes and subsidies collected/paid in moment t .¹¹ Thus, the government benefits from survival of a firm and can find it beneficial to bail it out in $t = 1$. It, however, cannot spend on subsidization more than the whole current budget. Further we call the probability α as a measure of paternalism of the government, because it reflects how much the government cares about the firms' survival. The time-line of the model is presented on figure 1.

⁹ Consideration of other shares of bargaining power will not change the main results of the model, but it will involve extra calculations. For example, for certain shares it is necessary to consider positive liquidation values.

¹⁰ Hart and Moore (1998) offer a rationale for free diversion of cash by managers without a perspective of jail - sales to a "friendly" firm by zero prices. This way does not work for tax evasion if to get rid of possibility of offshoring and black cash.

¹¹ We do not write down the liquidity constraint for the second period, because $S_2 = 0$ in the equilibrium. Further, we omit S_2 , and denote subsidies given in $t = 1$ as S .

2.2 Analysis of the basic model

Competitiveness of the credit market and certainty imply that only repaying firms get loans and contracted net interest rate is zero, i.e. $P = I$. There can be multiple equilibria with $P > K$. All these equilibria have no principle differences and we concentrate only on the equilibria with contracts (K, K) .

All firms try to get a loan, as their outside opportunity is zero (they initially have no cash, and consequently they do not invest). A firm repays if its debt D is lower than the benefit of survival $(1 - t)y_2$ and if it has enough cash for repayment, i.e. if $(1 - t)y_1 > D$. Thus, it repays only if $(1 - t) \min(y_1, y_2) > D$. If the government has no incentives to subsidize ($\alpha = 0$), then a firm is financed only if

$$\min(y_1, y_2) > \frac{K}{1 - t} \quad (2)$$

while the first-best is to finance if

$$y_1 + y_2 > K. \quad (3)$$

If the government collects quite large taxes in $t = 1$,¹² then it bails out a firm only if subsidy needed to create incentives to repay is lower than expected benefit from taxes in $t = 2$. If the government decides to subsidize a firm, then it minimizes expenditures on creating incentives to repay the debt (consequently, it pays nothing for those who would be financed under $\alpha = 0$). Therefore, the government gives a subsidy

$$S(y_1, y_2) = K - (1 - t) \min(y_1, y_2) \quad (4)$$

if

$$K - \alpha t y_2 < (1 - t) \min(y_1, y_2) < K. \quad (5)$$

Thus, the set of financed firms Y^F is:

$$Y^F \equiv \{(y_1, y_2) : K - \alpha t y_2 < (1 - t) \min(y_1, y_2)\}. \quad (6)$$

Figure 2 represents financing and subsidizing the firms as a function of their returns. The shaded area corresponds to self-repaying firms, the striped area corresponds to subsidized firms (in the case, when liquidity constraint of the government is not binding), the remaining area corresponds to not financed firms. Under no paternalism regime there are only self-repaying firms. Growth of α leads to expansion of the set of financed firms. This is the effect of implicit insurance by the government. We emphasize that the government does not care about the firms per se, but its stake in firms' future returns is used by the lenders. Under $\alpha = 1$ the set of financed firms still belongs to the set of financed firms in the first-best, what means that growth of paternalism leads to social improvement. The result is quite expected, as the government's implicit insurance cannot lead to financing inefficient projects (those with $y_1 + y_2 < K$), because a revenue maximizing government values the future return of firms not more than a benevolent government does.

The situation is different if liquidity constraint of the government is binding. In this case, the government

¹²In particular, if its liquidity constraint is not binding.

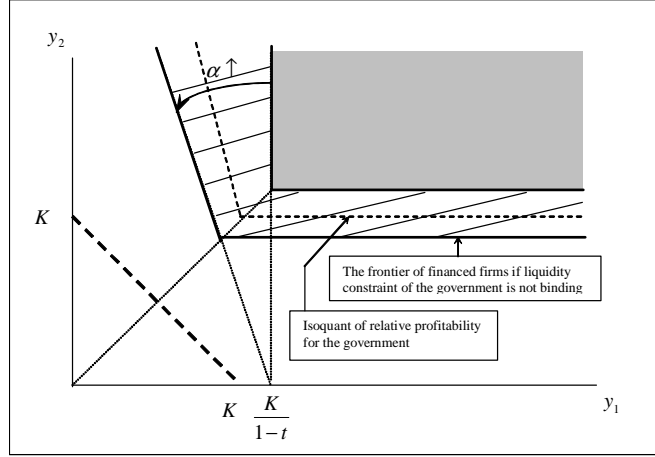


Figure 2: The solution with and without government intervention. The shaded area corresponds to $\alpha = 0$ (no government intervention). The growth of α increases the number of financed firms (the striped area is added to the set of financed firms). Additional financing is efficient, as the set of financed firms lies above the first-best frontier.

bases its decision on the relative profitability of bail out, which is $\pi_r = \frac{\alpha t y_2}{K - (1-t) \min(y_1, y_2)}$.¹³ It means that the government bails out a firm, if firm's relative profitability π_r is greater, than the threshold level $\bar{\pi}_r > 1$, and it has incentives to repay, i.e. if

$$(y_1, y_2) \in Y(\alpha, t, K, \bar{\pi}_r) \equiv \{(y_1, y_2) : K - \frac{\alpha t y_2}{\bar{\pi}_r} < (1-t) \min(y_1, y_2) < K\}, \quad (7)$$

where $\bar{\pi}_r$ is determined from the condition that the government's liquidity constraint is binding:

$$\iint_{Y(\alpha, t, K, \bar{\pi}_r)} (t y_1 - S(y_1, y_2)) dy_1 dy_2 = 0 \quad (8)$$

An allocation, in which all the firms from $Y(\alpha, t, K, \bar{\pi}_r)$ are financed, is the only allocation suspected to be an equilibrium, but it is not an equilibrium. Indeed, one of the lenders can intervene by contracting positive net interest rate with firms with very large y_1 , and $y_2 \in \left(\frac{K}{1-t}, \frac{K}{1-t + \frac{\alpha t}{\bar{\pi}_r}}\right)$.¹⁴ This intervention would increase the government revenues, and allow to it to bail out the (additionally) financed firms. Evidently, this strategy is not itself an equilibrium one. Thus, there is no equilibrium if sum of subsidies defined by (4) given to firms satisfying to (5) is lower than taxes paid by firms satisfying to condition of financing (6).

Paternalism provides extra liquidity to firms, what weakly improves them. Expansion of the set of financed firms combined with the fact that only firms that are to be financed in the first-best world are financed in the

¹³We omit discussion of problems caused by discreteness.

¹⁴These are very productive firms in the short-run that neither have incentives to repay on their own, nor are enough attractive for the government that has scare resources, but that would be subsidized, if the government could borrow in $t = 1$.

equilibrium, infers that growth of paternalism increases social welfare. Paternalism, however, is financed by taxes that are extracted from society, and only partially are returned. Moreover, there are firms that would be financed if there were no government, but are not financed under low α , because they are illiquid due to taxation (e.g. a firm with $(y_1, y_2) = (K, K)$). The question arises "Whether a grabbing government is needed at all?" The answer to this question is ambiguous. Surely some firms suffer from the government, as they pay taxes and gain nothing from the government, but at the same time some firms gain more than pay. Under some conditions total production with the government is higher than without it, even despite distorting taxation. The following example is an extreme case illustrating the idea: there are two types of firms - a share Δ of firms produce $y_1 = y_2 = K + \delta$, the remaining share $1 - \Delta$ produce $y_1 = K - \varepsilon$, and $y_2 = \frac{K}{\varepsilon}$, where $\delta, \varepsilon > 0$. Suppose that $(K + \delta)(1 - t) > K$, then for low ε the ratio of total output (in two periods) with the government to total output without the government is $\frac{2\Delta(K + \delta) + (1 - \Delta)((K - \varepsilon) + \frac{K}{\varepsilon})}{2\Delta(K + \delta)}$, and it approaches infinity, when $\varepsilon \rightarrow 0$. The corresponding ratio of firms' benefits, $\frac{\Delta(2(K + \delta)(1 - t) - K) + (1 - \Delta)(1 - t)\frac{K}{\varepsilon}}{\Delta(2(K + \delta)(1 - t) - K)}$, also approaches infinity, when $\varepsilon \rightarrow 0$.

Summing up, the presented simple model shows that under a fixed tax system growth in paternalism improves the situation, when it does not affect efforts. Formally lack of budget resources leads to no equilibrium situation. Further, we consider how the situation changes, when production is affected by managerial efforts.

3 A trade-off between the commitment problem and soft budget constraints

3.1 Setup

In this section, we develop further the model, considered above. We introduce moral hazard into the model. In particular, we assume that returns depend on costly efforts. For simplicity efforts are exerted only in period $t = 0$ after financing a project. Projects yield $y_1(e)$ in $t = 1$ and $y_2(e)$ in $t = 2$, where e is effort exerted by the manager. Functions $y_1(e)$, $y_2(e)$ are increasing and concave, and are *the same* for all the firms. It is assumed that $y_1(e) < y_2(e)$, and consequently all the managers prefer to repay, if they have enough cash in $t = 1$. All the firms are characterized by technical efficiency parameter θ . All the managers bear private cost $C(e, \theta)$, and costs are adversely related to θ . $C(e, \theta)$ satisfies standard conditions: $C(0, \theta) = 0$, $C_e(e, \theta) > 0$, $C_{ee}(e, \theta) < 0$, $C_\theta(e, \theta) < 0$ for all $e > 0$, and $C_{e\theta}(e, \theta) < 0$. Utility function of a manager of type θ is

$$U(\pi, e|\theta) = \pi - C(e, \theta), \quad (9)$$

where π is the monetary benefit of the manager. Efficiency types are distributed with atomless density function $f(\theta) > 0$ for all $\theta \geq 0$. There are extremely efficient firms: $C_e(e, \theta) \rightarrow 0$ with $\theta \rightarrow \infty$, and there are extremely inefficient firms: $C_e(e, \theta) \rightarrow \infty$ with $\theta \rightarrow 0$. We also assume that there is no production without efforts: $y_1(0) = y_2(0) = 0$, and that the technology allows to generate enough cash to repay aidless: $y_1(\infty) > \frac{K}{1 - t}$. These assumptions imply that there are always firms that are willing to repay on their own

if net interest rate is zero, and that there are firms that would not repay under any subsidy. We assume that $y_{1e}(0) = \infty$ to avoid corner solutions with $e = 0$ in the best response of firms. The time-line of the model is the same as on figure 1 with addition of costly efforts exerted in $t = 0$.

3.2 Analysis of the case when the government's liquidity constraint is not binding

3.2.1 The lenders and the government

The lenders' and the government's behavior is described in section 2. Once again, the lenders contract (K, K) with firms that repay, and $(0, 0)$ with the others. The government bails out firms if the subsidy to maintain incentives to repay is lower than the expected taxes paid in $t = 2$. If the government's budget constraint is binding, then the government bails out the firms that are the most "profitable" for it.¹⁵ In contrast to the model from section 2, now the government bails out only the firms that do not have enough cash on their own, because we assumed $y_1(e) < y_2(e)$.

For a while, we consider the case of *non-binding budget constraint of the government*. In this case, there is an implicit requirement level of efforts e_g , such that the government bails out all the firms that exert $e \geq e_g$ if they do not have enough cash to repay by themselves, and the firms exerting $e < e_g$ are to be liquidated.¹⁶ The level of e_g is determined from

$$K - (1 - t)y_1(e_g) = \alpha ty_2(e_g), \quad (10)$$

where $K - (1 - t)y_1(e_g)$ is the required subsidy and $\alpha ty_2(e_g)$ is expected tax payment to the current government in $t = 2$ if $e = e_g$. Let us denote e_0 as the level of effort required to repay, i.e. $(1 - t)y_1(e_0) = K$.¹⁷ Thus, only firms exerting $e \in [e_g, e_0)$ get a subsidy. Evidently, $\frac{de_g}{d\alpha} < 0$, i.e. growth of paternalism leads to lower requirements of the government to the firms, and soften their budget constraints.¹⁸

3.2.2 The firms

Conditional on getting a loan, firms choose between one of the following three basic strategies:

1) Exert effort lower than the government's requirement e_g . In this case, the firms get no subsidy and cannot repay. Thus, they default and are liquidated.

2) Exert effort not enough to repay on their own, but not lower than e_g .¹⁹ In this case, the firms get a subsidy equal exactly to the difference between debt and cash available to the firm: $S = K - (1 - t)y_1(e)$, and repay.

3) Exert effort enough to repay on their own. In this case, the firms get no subsidy, and repay on their own.

¹⁵ y_2 is monotonously increasing function of y_1 . Therefore, "profitable" and "profitable for the government" are synonyms.

¹⁶ Consequently, in equilibrium they are not financed.

¹⁷ Existence of e_0 follows from the assumption that $y_1(\infty) > \frac{K}{1-t}$.

¹⁸ Formally, differentiation of (10) by α yields $\frac{de_g}{d\alpha} = \frac{-ty_2(e_g)}{(1-t)y_1(e_g) + \alpha ty_2(e_g)} < 0$.

¹⁹ Properties of production functions insure that effort required to repay on your own is not lower than e_g .

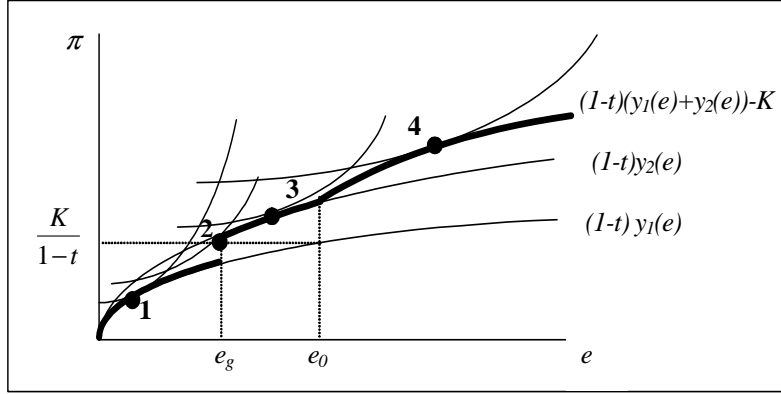


Figure 3: Profit schedule of firms conditional on getting a loan. Points 1, 2, 3, 4 show the choices of different firms for a given profit-schedule.

Accounting for the lenders' and the government's strategies and the fact that a firm repays whenever its cash flow in $t = 1$ is higher than its debt net of subsidy and when it has enough cash, the profit schedule $\pi(e, e_g, e_0)$ is

$$\pi(e, e_g, e_0) = \begin{cases} (1-t)y_1(e) & \text{if } e < e_g; \\ (1-t)y_2(e) & \text{if } e \in [e_g, e_0]; \\ (1-t)(y_1(e) + y_2(e)) - K & \text{if } e > e_0. \end{cases} \quad (11)$$

Denote the firms' reaction function in the case of non-binding government's liquidity constraint as $\tilde{e}(\theta, e_g, e_0)$. Figure 3 presents the profit schedule and the four possible types of firm's choice (four strategies). Let us rank these strategies as 1 (corresponds to point 1 on figure 3), when a firm chooses not to repay and divert all short-term cash $y_1(e)$; 2 (point 2), when a firm is subsidized, and the government is indifferent whether to bail out the firm or not (corner solution with subsidies); 3 (point 3), when a firm is subsidized, and the government benefits from bail out (interior solution with subsidies); and 4 (point 4), when a firm is self-financed. Corresponding efforts are²⁰

$$\begin{aligned} e_1^*(\theta) &= \arg \max((1-t)y_1(e) - C(e, \theta)); \\ e_2^* &= e_g; \\ e_3^*(\theta) &= \arg \max((1-t)y_2(e) - C(e, \theta)); \\ e_4^*(\theta) &= \arg \max((1-t)(y_1(e) + y_2(e)) - C(e, \theta)). \end{aligned} \quad (12)$$

Each firm chooses one of these points - the one which gives the highest profit.²¹ The following lemma simplifies the analysis of the best-response of the firms for a given level of paternalism.

Lemma 1. *For any two firms $\theta_1, \theta_2 : \theta_1 < \theta_2 \Rightarrow \tilde{e}(\theta_1, e_g, e_0) \leq \tilde{e}(\theta_2, e_g, e_0)$, i.e. more efficient firms*

²⁰Note, that $e = 0$ cannot be realized, because $y_{1e}(0) > 0$; and $e = e_0$ cannot be realized under $e_g < e_0$, because $y_{1e}(e) > 0$ and $y_{2e}(e) > 0$.

²¹Note that profit from exerting e_1^*, e_3^*, e_4^* is not always equal to the value of the maximized corresponding functional in the optimum point.

exert not lower efforts than less efficient firms do.²²

Proof. See Appendix.

3.2.3 Equilibrium under no paternalism regime

When $\alpha = 0$ the requirement level e_g is equal to e_0 . Consequently, e_3^* is not realized under $\alpha = 0$. Basically there are two types of equilibria: with and without set of firms that exert e_0 . Denote θ_{14} the solution of the following equation:²³

$$(1-t)y_1(e_1^*(\theta)) = (1-t)(y_1(e_4^*(\theta)) + y_2(e_4^*(\theta))) - K. \quad (13)$$

If the requirement level is low enough, in particular, if $e_0 \leq e_4^*(\theta_{14})$, then according to Lemma 1 all the firms with $\theta > \theta_{14}$ exert $\tilde{e}(\theta, e_0, e_0) = e_4^*(\theta) \geq e_4^*(\theta_{14}) > e_0$, i.e. they are financed and they exert $e_4^*(\theta)$.²⁴ All the firms with $\theta < \theta_{14}$ would exert $\tilde{e}(\theta, e_0, e_0) = e_1^*(\theta) < e_1^*(\theta_{14}) < e_0 \leq e_4^*(\theta_{14})$ if they were financed. Consequently, they are not financed, as they have no incentives to serve the debt. The firms with $\theta = \theta_{14}$ are indifferent between repayment and non-repayment. For simplicity of notation we assume that in such situations firms choose the highest level of effort, i.e. the effort of any firm is $\max(\tilde{e})$. Therefore, the firms with θ_{14} are financed.

If $e_0 > e_4^*(\theta_{14})$, then there are firms that are in the corner solution $e = e_0$, i.e. which repay everything what they earn in period $t = 1$. Denote the type of the firms that are indifferent between e_g and $e_1^*(\theta)$ as $\theta_{12}(e_g)$. The level of $\theta_{12}(e_g)$ is determined from:

$$(1-t)y_1(e_1^*(\theta)) = (1-t)y_2(e_g). \quad (14)$$

All the firms with $\theta < \theta_{12}(e_0)$ would exert $\tilde{e}(\theta, e_0, e_0) = e_1^*(\theta) < e_1^*(\theta_{12}) < e_0$, and they are not financed. All the firms, whose marginal costs of efforts at $e = e_0$ are not higher than marginal profit $(1-t)(y_{1e}(e_0) + y_{2e}(e_0))$ (these are only those with $\theta > \theta_{12}$), exert $e_4^*(\theta)$. All the remaining firms exert $e = e_0$. Generally, $\theta_{24}(e_g, e_0)$ is the border level of technical efficiency that separates strategies 2 and 4. The level of $\theta_{24}(e_g, e_0)$ is determined from:²⁵

$$\pi(e_g, e_g, e_0) - C(e_g, \theta) = \pi(e_4^*(\theta), e_g, e_0) - C(e_4^*(\theta), \theta). \quad (15)$$

Thus, if $e_0 > e_4^*(\theta_{14})$, then

$$\tilde{e}(\theta, e_0, e_0) = \begin{cases} e_1^*(\theta) & \text{for } \theta < \theta_{12}(e_0); \\ e_0 & \text{for } \theta \in [\theta_{12}(e_0), \theta_{24}(e_0, e_0)]; \\ e_4^*(\theta) & \text{for } \theta \geq \theta_{24}(e_0, e_0); \end{cases} \quad (16)$$

²² Generally $\tilde{e}(\theta, e_g, e_0)$ is not unique. Lemma 1 actually says that any firm with $\theta > \bar{\theta}$ exerts $e \geq \max(\tilde{e}(\bar{\theta}, e_g, e_0))$, and any firm with $\theta < \bar{\theta}$ exerts $e \leq \min(\tilde{e}(\bar{\theta}, e_g, e_0))$.

²³ The existence of the solution of this equation naturally follows from the properties of cost-function and concavity of production functions. Uniqueness follows from Lemma 1.

²⁴ In further analysis of equilibrium, we widely use Lemma 1 and equilibrium path strategies of the lender and the government, but we don't refer to them permanently to save the space.

²⁵ (14) and (15) are true for any α . Under $\alpha = 0$, θ_{24} is simply the solution of equation $e_4^*(\theta) = e_0$.

and if $e_0 \leq e_4^*(\theta_{14})$, then

$$\tilde{e}(\theta, e_0, e_0) = \begin{cases} e_1^*(\theta) & \text{for } \theta < \theta_{14}; \\ e_4^*(\theta) & \text{for } \theta \geq \theta_{14}. \end{cases} \quad (17)$$

3.2.4 Effect of paternalism on incentives and financing. Comparative statics.

In this section, we analyze the impact of paternalism on equilibrium. Since the level of paternalism α is adversely related to the level to the government's "requirement" e_g , we look at the changes that happen, when e_g decreases from e_0 to 0, what corresponds to changes of α from 0 to infinity.

First, consider the case, when $e_0 \leq e_4^*(\theta_{14})$, i.e. when only two strategies are possible - 1 and 4 under no paternalism regime. In this case, the equilibrium is the same as in the case $\alpha = 0$ and defined by (17) until $e_g < e'_g$, where e'_g is the level of the requirement, when firms of type θ_{14} have three optimal choices e_1^* , e_g , and e_4^* .²⁶ Further decline of e_g leads to switch of firms with $\theta = \theta_{14}$ from strategy 4 to strategy 2. The level of e'_g is derived from:

$$\pi(e_g, e_g, e_0) - C(e_g, \theta_{14}) = \pi(e_4^*(\theta_{14}), e_g, e_0) - C(e_4^*(\theta_{14}), \theta_{14}). \quad (18)$$

Suppose that the requirement level e_g is just a bit lower than e'_g . In this case there are firms (of type $\theta_{24}(e_g, e_0)$) that are indifferent between playing strategy 4 and strategy 2. The level of $\theta_{24}(e_g, e_0)$ is determined in the same way as in the case of no paternalism and is derived from (15). Further decline of e_g leads to switching some firms from strategies 1 and 4 to strategy 2. In particular, the most efficient firms that under lower α would choose not to repay, now would prefer repaying; the least efficient firms among those that repaid on their own decrease effort (and get a subsidy) when α grows. All subsidized firms are in the corner solution $\tilde{e} = e_g$, when e_g is just slightly lower than e'_g . Thus these firms benefit from further decline of α , because they get closer to their interior solutions $e_3^*(\theta)$ on the profit schedule branch $\pi = (1-t)y_2(e)$. At some point, however, further growth of paternalism does not benefit all of subsidized firms. Denote θ_{34} the level of technical efficiency of the firms that are indifferent between branches of the profit schedule giving $(1-t)(y_1(e) + y_2(e)) - K$ and $(1-t)y_2(e)$. The level of θ_{34} is derived from:

$$\pi(e_3^*(\theta), e_g, e_0) - C(e_3^*(\theta), \theta_1) = \pi(e_4^*(\theta), e_g, e_0) - C(e_4^*(\theta), \theta_1). \quad (19)$$

There are no firms playing strategy 3 (interior solution with subsidies) when $e_g > e_3^*(\theta_{34})$. When $e_g < e_3^*(\theta_{34})$, there are firms that get subsidies and exert effort higher than e_g . These are the firms with $\theta < \theta_{34}$ for which marginal cost of effort at e_g is lower than the marginal benefit $(1-t)y_{2e}(e_g)$. Thus, the border level of efficiency between firms playing strategies 2 and 3, $\theta_{23}(e_g)$, is determined from:

$$(1-t)y_{2e}(e_g) = C_e(e_g, \theta_{23}), \quad (20)$$

what is equivalent to $e_3^*(\theta_{23}) = e_g$.

²⁶ Evidently, $e'_g > e_3^*(\theta_{34})$.

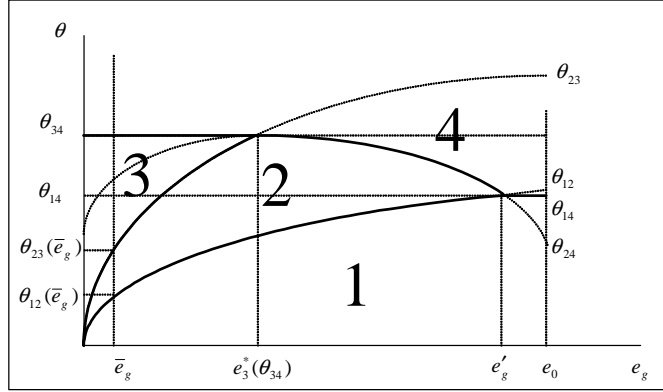


Figure 4: Graphical treatment of the equilibrium for $e_0 > e_4^*(\theta_{14})$.

Summing up, if $e_0 \leq e_4^*(\theta_{14})$, then the best response of firms is

$$\tilde{e}(\theta, e_g, e_0) = \begin{cases} e_1^*(\theta) & \text{for } \theta < \theta_{14}; \\ e_4^*(\theta) & \text{for } \theta \geq \theta_{14}; \end{cases} \quad \text{for } e_g \geq e'_g \quad (21)$$

$$\tilde{e}(\theta, e_g, e_0) = \begin{cases} e_1^*(\theta) & \text{for } \theta < \theta_{12}(e_g); \\ e_g & \text{for } \theta \in [\theta_{12}(e_g), \theta_{24}(e_g)]; \\ e_4^*(\theta) & \text{for } \theta \geq \theta_{24}(e_g); \end{cases} \quad \text{for } e_g \in [e_3^*(\theta_{34}), e'_g] \quad (22)$$

$$\tilde{e}(\theta, e_g, e_0) = \begin{cases} e_1^*(\theta) & \text{for } \theta < \theta_{12}(e_g); \\ e_g & \text{for } \theta \in [\theta_{12}(e_g), \theta_{23}(e_g)]; \\ e_3^*(\theta) & \text{for } \theta \in [\theta_{23}(e_g), \theta_{34}]; \\ e_4^*(\theta) & \text{for } \theta \geq \theta_{34}. \end{cases} \quad \text{for } e_g < e_3^*(\theta_{34}) \quad (23)$$

The analysis is similar in the case when $e_0 > e_4^*(\theta_{14})$. In this case, at any level of paternalism there are firms that exert minimum level of effort just necessary for repayment. If $e_g \in [e_3^*(\theta_{34}), e_0]$, then the best response of firms is defined by (22), and if $e_g < e_3^*(\theta_{34})$, then the best response of firms is defined by (23).

The presented analysis implies that one needs to determine borders of efficiency $\theta_{12}(e_g)$, θ_{14} , $\theta_{23}(e_g)$, $\theta_{24}(e_g, e_0)$, $\theta_{34}(e_0)$, and effort/requirement levels e_0 , e'_g , $e_3^*(\theta_{34})$, $e_4^*(\theta_{14})$ to describe equilibrium at any level of paternalism α . It is also needed to analyze dependence of borders from paternalism to study comparative statics. In Appendix we formally show that

$$\frac{\partial \theta_{12}}{\partial \alpha} < 0, \quad \frac{\partial \theta_{23}}{\partial \alpha} < 0, \quad \frac{\partial \theta_{24}}{\partial \alpha} \begin{cases} > 0 & \text{for } e_g < e_3^*(\theta_{34}); \\ < 0 & \text{for } e_g > e_3^*(\theta_{34}). \end{cases}$$

Figure 4 presents graphical treatment of the solution for the case, when $e_0 > e_4^*(\theta_{14})$. Growth of paternalism corresponds to reading the figure from right to left. Under $\alpha = 0$ (which corresponds to e_0) two strategies

are realized: 1 and 4. Firstly, increase of paternalism leads to no changes, until e_g reaches e'_g . Then further increase leads to realization of strategy 2: the most technically efficient firms among those that were not financed under lower levels of α and the least efficient among those that were self-repaying switch to exerting e_g . Further growth of paternalism expands the set of subsidized firms at the expense of sets consisting of self-repaying and not financed firms. When α is so high that $e_g < e_3^*(\theta_{34})$, then all the four strategies are realized. Further growth of paternalism has no effect on the set of self-financed firms; the most efficient firms that exerted e_g exert efforts higher than the (reduced) requirement, and consequently the set of firms playing strategy 3 expands at the expense of firms playing strategy 2. At the same time, the number of firms that exert efforts just to repay expands due to switches from the set of firms that are not financed under lower α . If $e_0 < e_4^*(\theta_{14})$, then graphical treatment of analysis of equilibrium looks similarly, but without part to the right from e'_g (on figure 4).

Figure 4 yields several conclusions about relation between lending, subsidization, technical efficiency and efforts. It follows from $\frac{\partial \theta_{12}}{\partial \alpha} < 0$ that the number of financed firms non-strongly increases with growth of paternalism.²⁷ Denoting the measure of firms that get loans as $L(\alpha)$, this claim is summarized in Proposition 1A.

Proposition 1A. $\frac{dL}{d\alpha} \geq 0$, i.e. the higher level of paternalism, the more firms are financed.²⁸

If we denote the indicator of financing firm θ as $l(\alpha, \theta)$, we can get a stronger version of Proposition 1A:

Proposition 1B. $l(\alpha, \theta)$ is a non-decreasing function of α .

Another proposition follows from Lemma 1, properties of borders of the set of subsidized firms (those that play strategies 2 or 3), and the fact that the higher exerted effort leads to lower given subsidy (if any):

Proposition 2. Only firms with intermediate efficiency and intermediate efforts are subsidized. If a firm gets a subsidy, then the higher its effort, the lower the subsidy: $\frac{\partial S}{\partial \theta} \leq 0$, if $S > 0$.

Figure 4 can be drawn in effort-requirement axes. For this sake, one needs to determine levels of the requirement, when the firms switch strategies. Denote the level of the requirement, when a firm θ is indifferent between strategy i and strategy j as $e_g^{ij}(\theta)$. On figure 4 these levels are intercepts of horizontal lines corresponding to θ and borders of sets i and j . These levels are determined from the following equations:

$$\begin{aligned} e_g^{12}(\theta) : & \quad \pi(e_1^*(\theta), e_g, e_0) - C(e_1^*(\theta), e_g, e_0) = \pi(e_g, e_g, e_0) - C(e_g, e_g, e_0); \\ e_g^{23}(\theta) : & \quad e_3^*(\theta) = e_g; \\ e_g^{24}(\theta) : & \quad \pi(e_4^*(\theta), e_g, e_0) - C(e_4^*(\theta), e_g, e_0) = \pi(e_g, e_g, e_0) - C(e_g, e_g, e_0). \end{aligned}$$

Figure 5 illustrates the dependence of efforts on the requirement level. We again analyze comparative statics when paternalism grows. Firms with $\theta \geq \theta_{34}$ always exert $e_4^*(\theta)$ and they are not shown on figure 5. Consider a firm with $\theta < \theta_{34}$ that plays strategy 4 under $\alpha = 0$ (figure 5.a). Initially this firm does not respond to a decrease in the requirement level, however, at $e_g = e_g^{24}(\theta)$ it switches to strategy 2 and keeps $e = e_g$ until $e_g \leq e_g^{23}(\theta)$. When $e_g = e_g^{23}(\theta)$ the firm switches from strategy 2 to strategy 3. Further decline of e_g has no effect on this firm. Now consider a firm that plays strategy 2 under $\alpha = 0$ (figure 5.b). This firm follows strategy 2 until $e_g \leq e_g^{23}(\theta)$. Further growth of paternalism ($e_g < e_g^{23}(\theta)$) leads to an interior

²⁷ This is also true in case when θ_{12} is not determined, i.e. when $e_g > e'_g$ and $e_0 < e_4^*(\theta_{14})$.

²⁸ $\frac{dL}{d\alpha}$ is strictly positive if $e_0 > e_4^*(\theta_{14})$ and $e_g < e'_g$, or if $e_0 \leq e_4^*(\theta_{14})$.

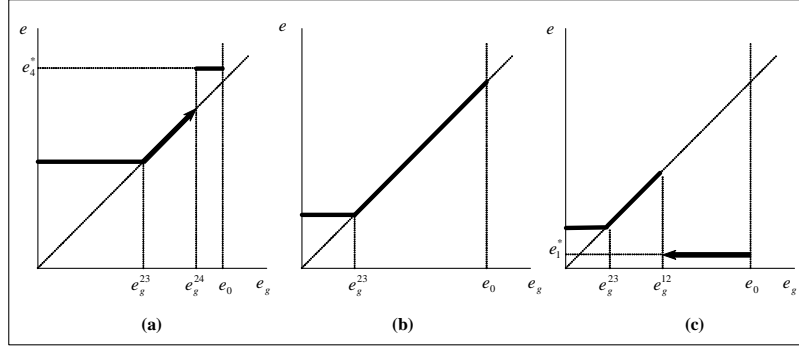


Figure 5: Dependence of efforts on the level of the government's requirement: (a) for firms with $\theta < \theta_{34}$ that play strategy 4 under $\alpha = 0$; (b) for firms play strategy 2 under $\alpha = 0$; (c) for firms play strategy 1 under $\alpha = 0$.

solution on the profit schedule branch with subsidies, $e_3^*(\theta)$. Finally, consider a firm that is not financed under no paternalism regime (figure 5.c). This firm would divert all the cash in $t = 1$, if it were financed, until $e_g \leq e_g^{12}(\theta)$. Further growth of paternalism leads to exerting effort equal exactly to the requirement, until $e_g \leq e_g^{23}(\theta)$. At $e_g = e_g^{23}(\theta)$ the firm switches to $e_3^*(\theta)$ and follows this strategy for all $e_g \leq e_g^{23}(\theta)$.

Thus, conditional on getting a loan, firms exert lower efforts under higher level of paternalism. The presented discussion brings us to the following lemma:

Lemma 2. *If a firm is financed both under α_1 and under α_2 , such that $\alpha_1 < \alpha_2$, then $\tilde{e}(\theta, e_g(\alpha_1), e_0) \geq \tilde{e}(\theta, e_g(\alpha_2), e_0)$.*

This is a quite standard result of soft budget constraints. We use it in the further analysis.

3.3 Limitations of paternalism - liquidity constraint of the government

In previous sections we considered equilibrium with an implicit assumption of non-binding government's liquidity constraint. In this section, we analyze the equilibrium under binding liquidity constraint. First we assume that the government can borrow in period $t = 1$, i.e. the government can have negative balance of payments in $t = 1$, and investigate how the government's balance of payments depends on paternalism. Then, using this dependence we find equilibrium under binding liquidity constraint.

If the government can borrow in $t = 1$, then it bails out all the firms that exert $e > e_g$, where e_g is determined from (10). Denote the difference between total tax payments in period 1 and total subsidies that would be given if the government could have negative balance of payments as $B(\alpha)$.²⁹ This function has the following properties:

- (a) $B(0) > 0$;
- (b) If there is α^* such that $B(\alpha^*) = 0$, then $B(\alpha) < 0$ for $\alpha > \alpha^*$. Moreover, $B_\alpha(\alpha) < 0$ for $\alpha > \alpha^*$.

Proof. See Appendix.

²⁹Thus we allow $B < 0$. If the government cannot borrow, then its liquidity constraint in terms of B is $B \geq 0$.

The intuition behind the proofs of properties is the following: (a) if the government does not bail out, then its budget is positive, because there are always self-repaying firms; (b) reduction of the government's requirement reduces incentives of firms that are financed under higher level of the requirement, and additionally financed firms are the least efficient, and correspondingly bring negative value to the short-term balance of payments.

At this stage we bring liquidity constraint back to the problem of the government. On the basis of properties of $B(\alpha)$ we show that the growth of paternalism above α^* leads to no changes of equilibrium.

Proposition 3. *If $\exists \alpha^*$: $B(\alpha^*) = 0 \Rightarrow$ equilibrium for $\alpha > \alpha^*$ is the same as under α^* .*³⁰

Proof. See Appendix.

Proposition 3 has tremendous policy implications. It implies that in the case of federal structure of an economy, which takes place in Russia, a federal center can make improvements using transfer system. On the one hand, it is possible to limit paternalism in relatively rich regions, when soft budget constraint dominates positive effect of overcoming the commitment problem, on the other hand, it allows an implicit insurance to work in poorer regions, in which effect is strongly limited by initial distribution of firms with little number of technically developed firms.

3.4 Effect of paternalism on social welfare and production

In this section, we consider how paternalism affects social welfare. Due to quasilinearity of preferences of all the agents, we consider the sum of all utilities as a social functional. This functional includes all the collected taxes, because independent of who keeps the power, the collected taxes yield utility to power holder. Including creditors' utility into the social functional is not essential, because in any equilibrium lenders receive zero profits. The first-best is to finance firms with

$$\max_e (y_1(e) + y_2(e) - C(e, \theta)) \geq K, \quad (24)$$

and optimal efforts of financed firms are correspondingly

$$e^* = \arg \max (y_1(e) + y_2(e) - C(e, \theta)). \quad (25)$$

Social welfare is given by

$$\begin{aligned} SW(\alpha) = & \int_{\theta_{12}}^{\theta_{24}} (y_1(e_g) + y_2(e_g) - C(e_g, \theta) - K) dF(\theta) + \\ & + \int_{\theta_{24}}^{\infty} (y_1(e_4^*(\theta)) + y_2(e_4^*(\theta)) - C(e_4^*(\theta), \theta) - K) dF(\theta) \end{aligned} \quad (26)$$

³⁰ If $B(1) \geq 0$, then liquidity constraint is never binding.

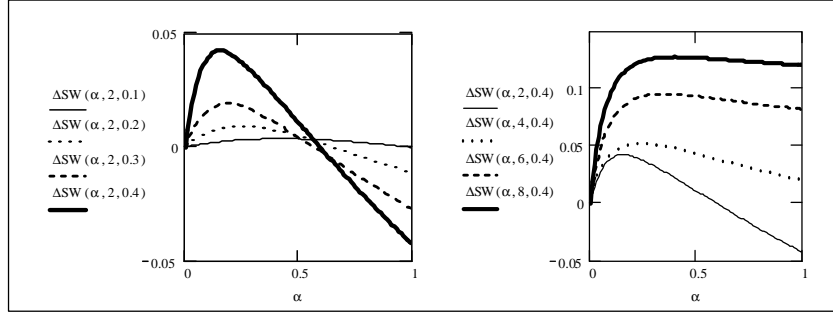


Figure 6: Dependence of social welfare $\Delta SW(\alpha, \lambda, t, K) = SW(\alpha, \lambda, t, K) - SW(0, \lambda, t, K)$ on paternalism for $y_1(e) = e$, $y_2(e) = \lambda e$ ($\lambda > 1$), $C(e, \theta) = \frac{e^2}{2\theta}$, $\theta \sim U[0, 10]$, $K = 1$.

when three firms' strategies are realized, and by

$$\begin{aligned}
 SW(\alpha) = & \int_{\theta_{12}}^{\theta_{23}} (y_1(e_g) + y_2(e_g) - C(e_g, \theta) - K) dF(\theta) + \\
 & + \int_{\theta_{23}}^{\theta_{34}} (y_1(e_3^*(\theta)) + y_2(e_3^*(\theta)) - C(e_3^*(\theta), \theta) - K) dF(\theta) + \\
 & + \int_{\theta_{34}}^{\infty} (y_1(e_4^*(\theta)) + y_2(e_4^*(\theta)) - C(e_4^*(\theta), \theta) - K) dF(\theta)
 \end{aligned} \tag{27}$$

when there are four firms' strategy realizations.³¹

Due to Proposition 1A, growth of paternalism leads to increased financing, what improves the situation. At the same time, growth of paternalism reduces incentives. Depending on the type of a firm and level of paternalism, marginal effect of effort decrease can bring the firm closer to the first-best solution or farther from it. The model gives no direct predictions for the marginal effect of paternalism under any α , but some conclusions can be made for the case $\alpha = 0$. Evidently there is no effect of small increase of paternalism for the case $\alpha = 0$, if $e_0 > e_4^*(\theta_{14})$, i.e. if there are only two types of firms' strategies.

Let us consider the case $e_0 \leq e_4^*(\theta_{14})$. Social welfare in this case is represented by (26). Using Leibnitz's rule, we differentiate (26) by e_g at e_0 and get:

³¹The case, when only two types of firms' strategies are realized, is not considered in the paper, because there is no marginal effect of paternalism in this case.

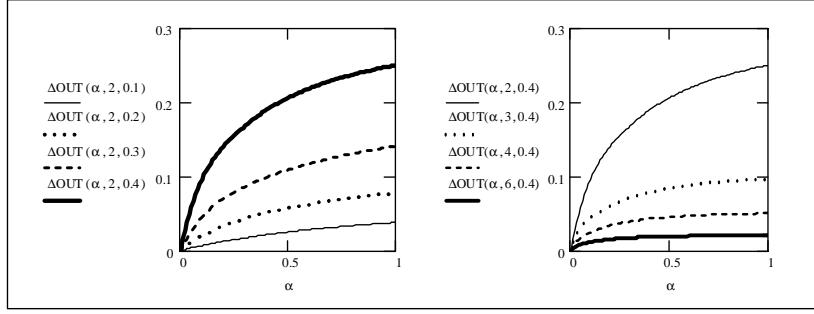


Figure 7: Dependence of output $\Delta OUT(\alpha, \lambda, t, K) = OUT(\alpha, \lambda, t, K) - OUT(0, \lambda, t, K)$ on paternalism for $y_1(e) = e$, $y_2(e) = \lambda e$ ($\lambda > 1$), $C(e, \theta) = \frac{e^2}{2\theta}$, $\theta \sim U[0, 10]$, $K = 1$.

$$\begin{aligned}
\left. \frac{\partial SW}{\partial e_g} \right|_{e_g=e_0} &= \int_{\theta_{12}}^{\theta_{24}} (1-t) (y_{1_e}(e_0) + y_{2_e}(e_0) - C_e(e_0, \theta)) dF(\theta) + \\
&\quad + t \int_{\theta_{12}}^{\theta_{24}} (y_{1_e}(e_0) + y_{2_e}(e_0)) dF(\theta) - \\
&\quad - (y_1(e_0) + y_2(e_0) - C(e_0, \theta) - K) f(\theta_{12}) \frac{\partial \theta_{12}(e_0)}{\partial e_g}.
\end{aligned} \tag{28}$$

The first and the last terms in (28) are negative, while the second term is positive. Thus, under relatively low taxes, social welfare is an increasing function of paternalism at $\alpha = 0$. In other words, if the positive effect of commitment problem on incentives of some firms among those that exert e_0 under $\alpha = 0$ is neglected, then a small increase of paternalism positively affects the social welfare.

The model does not give straightforward results for the effect of paternalism on production, as due to increased paternalism a certain share of financed firms reduce the output, but newly financed firms arise. These two effects work in opposite directions and the correspondent marginal effects caused by the change in paternalism are of the same order - many firms slightly reduce production versus small fraction of firms increases production from 0 to $y_1(e_g)$. Thus the effect of paternalism on the industrial development remains purely empirical question.

The dependence of the social welfare and the aggregate output on the level of paternalism can be illustrated on the basis of a simple example. Consider $y_1(e) = e$, $y_2(e) = \lambda e$ ($\lambda > 1$), $C(e, \theta) = \frac{e^2}{2\theta}$, $\theta \sim U[0, 10]$, $K = 1$.³² Figures 6-7 present corresponding illustration.

It is noteworthy that the more economy loses from the commitment problem (equivalently, the higher tax rate leading to liquidity problems and the higher growth rate), the more the economy gains from a small

³²We picked such example for simplicity of calculations. Even though it does not completely satisfy the assumptions of the model, the preceding theoretical analysis would still be valid.

increase in paternalism at $\alpha = 0$. The maximum gains from paternalism are also higher in these cases.

4 Testable hypotheses and empirical methodology

In this section, we state testable hypotheses and discuss the approach to their testing. We also describe available data sources. It should be noted that our data are of panel structure, therefore, we may employ panel data estimators, which allow us to solve the problem of unobserved heterogeneity among firms.

4.1 Hypotheses and estimation models

In section 3, we showed how the government could reduce negative effect of firms' inability to commit to repayment in the long-term. Our model yields straightforward conclusions about relations between investment, subsidization, performance and government's care about the future for the case of revenue maximizing government.

The model does not include many features that could characterize Russia. The main two assumptions are exogeneity of incumbent's probability to get re-elected, α , and complete independence of lenders from the government. The first assumption hardens the choice of the proxy for the government's care about the future, α . Actually, one of the potential proxies for α is the closeness of elections. According to the model the government has lower incentives to bail out, as it will survive with lower probability. On the other hand, subsidization can increase probability to win elections and closeness to elections would stimulate implicit firms' insurance. Without the second assumption our model would have no sense. Akhmedov (2000) provides empirical evidence for the years 1996-1998 that banks pursued economic goals rather than political ones. His study provides the ground for our assumptions.

The first two hypotheses relate firms' performance, level of subsidization and government's care. As we showed in section 3, firms with intermediate levels of productivity are more likely to receive government subsidies than firms with more extreme level of productivity. At the same time, as the amount of subsidy is inversely related to the output in our model, among those firms, which are granted with subsidies, less productive firms get relatively more subsidies. Thus we can propose the following hypotheses:

Hypothesis 1. *Extremely efficient and extremely inefficient firms are less likely to receive subsidies than firms with intermediate levels of efficiency.*

Hypothesis 2. *Among those firms that receive subsidies less efficient firms receive relatively higher subsidies.*

When analyzing government subsidies, we have to account for the fact that our sample contains both firms, which are granted with subsidies, and those, which are not. Thus we face a sample "selection" problem in a sense that those firms, which got subsidies, were selected somehow and that the government officials' decisions about granting a subsidy and about its size may be independent from each other.³³

³³Note that if we assume that underlying processes for the choice of firms, which receive subsidies, and the determination of the amount of a subsidy are the same, censored regression estimation (Tobit I model) could be employed instead. However, we cannot see an a priori justifiable explanation of why these processes are the same, even though some of the factors influencing these decisions may necessarily coincide. This is also a reason of why we put quotation marks for a selection term – our model is not a selection model in a usual sense as we can always observe dependent variable.

To account both for unobserved heterogeneity and sample selection, the first two hypotheses are tested by using the estimation of a panel data sample selection model³⁴ with firms' fixed effects in both selection and main equations:³⁵

$$\begin{cases} y_{it}^* = x_{it}^* \beta + \alpha_i^* + \varepsilon_{it}^*; \\ y_{it} = d_{it} y_{it}^*; \\ d_{it} = I(z_{it} \gamma + \eta_i - u_{it} > 0). \end{cases} \quad (29)$$

There exist at least three different estimators for such models, which are proposed by Wooldridge (1985), Kyriazidou (1997) and Rochina-Barrachina (1999). The estimators differ in assumptions that are imposed on the distribution of error terms and selection term. The second estimator seems to be the most appealing, as it is more flexible in the sense that it does not impose parametric assumptions on the distribution of any of the unobservables. This estimator is based on the fact that the sample selection effects are equal for the firms, for which $z_{it} \gamma = z_{is} \gamma$ and $d_{it} = d_{is} = 1$, therefore taking pairwise differencing eliminates not only unobserved heterogeneity but also the selection problem.

Thus two-step Heckman procedure could be applied, where γ is estimated in the first step and β is estimated in the second step by weighted least squares regression applied to the first differences with higher weights given to observations such that $(z_{it} - z_{is}) \hat{\gamma}$ is close to zero, and where 'kernel' weights can be used.

Asymptotic normality of the estimator $\hat{\beta}$ is obtained under the assumption that the convergence rate of the estimator for β is slower than the convergence rate of the estimator for γ . To satisfy this requirement, the selection equation could be estimated by conditional logit (Chamberlain, 1980) or smoothed maximum score methods (Horowitz, 1992).

There are not many empirical applications of Kyriazidou's method in the literature. Charlier, Melenberg and van Soest (2001) apply the described method to investigate expenditures on housing in Netherlands. However, the overidentification restrictions of their model were rejected, which might testify for misspecification. Dustmann and Rochina-Barrachina (2000) compare this method to the other two mentioned methods in application to estimation of effect of labor experience on wages. The estimator does not perform well in their study, because a conditional exchangeability assumption, imposed by Kyriazidou (1997), which is crucial for estimation, is rejected by the data. Besides, identification problems arise when any variation in experience coincides with changes in the selection index. These results show that we should be careful in implementation of the method in our study.

We apply Kyriazidou's estimator to investigate the level of subsidies given to enterprises:

$$\begin{cases} S_{it}^* = x_{it} \beta_1 + Prod \beta_2 + \alpha_i + \varepsilon_{it}; & i = 1, \dots, N; \quad t = 1, \dots, T \\ S_{it} = d_{it} S_{it}^*; \\ d_{it} = I(z_{it} \gamma_1 + Prod_{it} \gamma_2 + Prod_{it}^2 \gamma_3 + \eta_i - u_{it} > 0), \end{cases} \quad (30)$$

where d_{it} takes value of one, if a firm receives a subsidy. To test hypothesis 1 we are interested in the effect of a square term of a productivity parameter ($Prod$) on the indicator variable d_{it} . The effect of this productivity

³⁴This is a panel version of Tobit II model in Amemiya's (1985) classification.

³⁵We prefer fixed effects specification to random effects approach, because the latter is non-robust to distributional assumptions, which are necessary to be imposed in this case, and, besides, it is computationally cumbersome.

parameter on the logarithm of subsidies per capita S_{it}^* in the main equation will help us test hypothesis 2. It should be emphasized that the main equation is estimated for firm i only for such pairs of periods t and s , for which $d_{it} = d_{is} = 1$. Due to the definition of the selection index d_{it} the second step of the estimation procedure is carried out only for firms receiving subsidies, which is the exact statement hypothesis 2.

The productivity parameter $Prod$ is measured as a deviation of firm's costs per ruble of sales from the industry annual average level in the region of firms' location.³⁶ Such measure allows us to account for the differences in firms' cost functions across industries and across regions. The vector z_{it} contains a logarithm of real regional subsidies per worker in the region net of federal trend, a relative size of a firm in a correspondent region in terms of employment and time dummies. The vector x_{it} contains the same variables, excluding firm's size.³⁷

Accounting for the fact that, other things being equal, higher costs indicate lower performance, and given the predictions of our model, the negative sign of the estimate $\hat{\gamma}_3$ would allow us not to reject the hypothesis 1, and the positive estimate $\hat{\beta}_2$ would justify our conjecture that less productive firms receive relatively higher subsidies.

Another prediction of our model is that lenders are more willing to provide loans to firms under higher levels of government paternalism. Intuitively, since more firms are likely to receive subsidies, more firms will be able to return loans, and lenders are less reluctant in lending. Thus, we can state our third hypothesis.

Hypothesis 3. *The softer is the regional government, the higher is the level of outside investment.*

To test hypothesis 3 we measure the level of softness of the government using the level of regional subsidies to enterprises per worker. We are employing panel logit specification with firms' fixed effects:

$$l_{it} = I(Subs_{it}\theta_1 + m_{it}\theta_2 + \chi_i + \xi_{it} > 0) \quad (31)$$

where l_{it} is an indicator which takes value one if a firm receives a loan. Vector m_{it} contains time dummies, a relative size of a firm in a correspondent region in terms of employment, and a logarithm of a lag of a productivity parameter, measured as deviation of firm's costs per ruble of sales from the regional average level in the industry.

We do not reject hypothesis 3 if we get a positive and statistically significant estimate for coefficient θ_1 . Note, that as discussed above, we can substitute subsidies with the time left before elections, which is another proxy for the government's softness. Then, in this case we expect a negative coefficient for this variable to support the hypothesis: the less time is left before election, the harder is the government and less loans are given, since government will get taxes with lower probability. Alternatively, Treisman and Gimpelson (2001) emphasize the trade-off between different instruments of manipulation of public opinion and subsidies can be one of useful instruments to get votes. Thus, the opposite result would mean that the assumption that probability of winning does not depend on the government subsidies was too strong. Moreover, Akhmedov, Ravichev and Zhuravskaya (2003) show that industrial subsidies are widely used on

³⁶As it is common for similar datasets there could be a measurement error problem, associated with our data. However, as Dustman and Rochina-Barrachina (2000) illustrate, differencing out, which is used in Kyriazidou's approach, eliminates this problem even if a variable enters the equation in a non-linear way.

³⁷We exclude firm's size to satisfy exclusion restriction of the method.

the eve of regional elections and increase the probability of winning. Thus, it is more likely that political benefits should be accounted for. Overall, while the reasons of the government care about the firms are not so important, the essence is that the government actually finance firms, and rational lenders are to account for it.

4.2 Data and sample

In our analysis we are using a Goskomstat's³⁸ database on Russian firms' balance sheets, which contain characteristics of firms' performance, including their capital structure, level of received bank loans and subsidies for the years 1996-2000. After cleaning data we draw a sample of firms with non-missing data on the amount of loans and subsidies. We updated data on output and employment from the Russian Enterprise Registry Longitudinal Database (RERLD). Additional data on employment were drawn from the website of Federal Securities Commission. Data on aggregate regional subsidies were taken from monthly budgets of regions, published by Ministry of Finance, and data on regional employment from the statistical abstract "Russia's Regions", published annually by Goskomstat. We corrected all monetary variables for the denomination of the year 1998, and we adjust for the level of region-specific inflation so that all variables are in thousands of rubles of 1997. The final correction for outliers was done by dropping all observations, which did not fit in the middle 98% of the distribution (the highest and the lowest 1%).³⁹

For our analysis, we use all the firms whose balance sheets are present for at least two years. Table 1 presents description of the sample. Interestingly, average amount of subsidies given to firms was incredibly high in the year 1996 and has significantly decreased afterwards. The situation was similar for the average amount of loans. The financial crisis of 1998 was probably the main reason of the sharp decline in average amount of subsidies and loans.

The changes in the relative amounts of subsidies and loans were not so profound. The average levels of subsidies and loans per ruble of output were the highest in the year 1996 (Table 2). There was a sharp decline afterwards, followed by a little variation in the amount of relative subsidies starting from the year 1997 and a gradual increase in the average amount of loans per ruble of output. Analogous observations are true for the average amounts of loans and subsidies per worker. It should be noted that firms with subsidies were more likely to get loans in all years except the year 1997: the average level across groups differed from 2 per cent to a few times. At the same time, no similar pattern across years was observed for the amount relative subsidies depending on the firms' receipt of loans.

Description of the variables with the distribution by amount of subsidies and loans is given in Table 3. The variable *Cost*, which stands for the productivity parameter, was computed as a deviation of firm's costs from the industry average level in the region in corresponding year. Note, that firms, which receive not only subsidies, but also loans, tend to be located in regions with higher level of regional subsidies. Besides these firms are bigger on average than firms, which are not financed.

The distribution of firms by the amount of subsidy and amount of loan is presented in Table 4. The

³⁸The State Committee on Statistics of the Russian Federation.

³⁹Bollinger and Chandra (2001) suggest an optimal trimming ways for the analysis of OLS models, however, there are no justifiable methods for semi-parametric methods. Therefore, our trimming thresholds are arbitrary.

number of firms receiving bank loans relative to that of not granted firms in our sample has decreased significantly by 1998, but has been increasing since then. This pattern is probably explained by the fact that a part of banks' resources released after the crash of government bond market in 1998. Besides, it may be a sign of the gradual banks' recovery after the financial crisis.

5 Estimation results

The results of estimation are presented in Table 5. We employed the conditional logit method to estimate the selection equation in (30) and test hypothesis 1. For each firm this estimation technique employs only those pairs of periods, between which there was a switch in the subsidization policy. Thus if such transitions are rare to observe, the estimation could be imprecise. The policy switch occurred in 22 percent of transitions across periods for firms in the sample used for the selection equation estimation, and we suppose this number of switches to be sufficient for application the technique.

Significant negative coefficient for the squared term of productivity parameter supports hypothesis 1: very efficient and very inefficient firms are less likely to get a government subsidy. Another statistically significant result is that firms with higher weight in regional employment have higher probability to be supported. This result can be explained both by political motives and by economic ones. On the one hand, large firms have larger political weight, as they employ a significant share of local population (for example Novolipetsky Metallurgy Combinat employs up to 15% of regional center's, Lipetsk, labor force). On the other hand, large firms are easier to be taxed, as average monitoring costs decrease with scale (see Gehlbach, 2003). The estimates for the time dummies testify that the likelihood of receiving a subsidy was higher in the middle of 1990s rather than later.

We use the results of the conditional logit estimation to construct kernel weights for the pairs of periods in the main equation estimation. We employ a normal density first order kernels. We use Horowitz's (1992) procedure to deal with the problem of bandwidth selection. Briefly, optimal bandwidth is chosen as a value, which yields the minimum of mean square error constructed using some arbitrary initial level of bandwidth.⁴⁰

While the positive sign of the coefficient for the productivity parameter does support our prediction that more inefficient firms get relatively higher subsidies, the t-test does not reject the hypothesis that this coefficient is equal to zero. This result might be caused by the fact that the variation in costs is highly correlated with the variation in the selection index. Interestingly, time dummy variables are highly significant and mirror the patterns in the data: relatively higher subsidies per capita were given in the middle of 1990s.

Finally, the results of the estimation of conditional logit model for testing hypothesis 3 show that firms are more likely to get a bank loan in regions with higher level of subsidies, which goes in accordance with the prediction of our model. At the same time, more productive firms have more chances to get a loan, what is one of the direct predictions of the model. The analysis of time dummies shows that lenders were less willing to provide loans in the years from 1997-1999, with the year 1998 being the toughest in this sense. The last observation could be explained by highly volatile financial atmosphere of the year 1998: in the first half of

⁴⁰This method is similar to the plug-in method used in kernel density estimation.

the year there was a huge rise in the amount of traded government obligations and there was a financial crisis with all its consequences afterwards.

Summing up, we observe that in spite of omitting political goals in the model, the most of hypotheses, following from it, cannot be rejected by the employed tests. The most striking result is that firms get loans more likely in the regions with higher subsidies. It signals that lenders could consider local government's "softness" as an implicit insurer of firms.

6 Conclusions and policy implications

The paper offered an alternative view on the government's "softness" and its impact on efficiency. We built a theoretical model based on the framework of model of Hart and Moore (1989) by including the government caring about only net expected budget revenues. We showed that the decision whom to subsidize depends on firms' performance in a non-monotonic way. At the same time, conditional on getting a subsidy, the value of subsidy negatively depends on firms' performance. We also showed that financing increases with the growth in the level of government's paternalism. However, these effects are limited by the government's liquidity constraint: when it becomes binding, the further growth in paternalism does not have any impact.

The model shows that the government's care about firms brings in three effects: negative effect of soft budget constraints and positive effects of increased financing and reduced overproduction, caused by short-term liquidity constraints. We showed that under relatively low tax rate positive effects overweight.

We tested our conjectures using data on balance sheets of Russian firms for 1996-2000. We employed semi-parametric methods to avoid imposing limiting distributional requirement. The results of estimation mainly support our hypotheses. We found that firms with intermediate levels of productivity are more likely to get subsidies and that the "softness" of the regional governments stimulates banks' lending to firms, which we consider as the main result of the paper. At the same time we did not find significant evidence that less productive firms receive more subsidies.

The fact that subsidization policy may affect lending process offers a venue for policy design. In particular, for regional policy one can think about altering probability of regional governor re-election by an upper level authorities and federal transfers to a region as policy instruments. The former has various restrictions, including moral ones. The latter allows to reduce costs of the lack of commitment by smoothing regional differences.

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Table 1. Description of the sample.

Year	Number of firms	Avg. amount of subsidies (in thous. rubles of 1997)	Avg. amount of loans (in thous. rubles of 1997)
1996	472	34588 [378532.8]	189157 [2034780]
1997	3421	4304 [70968.1]	48421 [1628934.1]
1998	4883	1611 [26279.7]	17473 [242878.7]
1999	5449	2340 [43109.5]	27914 [444137.3]
2000	4395	1546.3 [20564.6]	21704 [239537.7]

Note: Standard errors are in parentheses.

Table 2. Distribution of relative subsidies and loans over years.

Year	Subs/Out	Subs/Out if Loan=0	Subs/Out if Loan>0	Loan/Out	Loan/Out if Subs=0	Loan/Out if Subs>0
1996	0.175	0.012	0.218	0.222	0.047	0.270
1997	0.018	0.026	0.011	0.065	0.078	0.059
1998	0.032	0.049	0.014	0.157	0.105	0.216
1999	0.042	0.052	0.031	0.271	0.251	0.299
2000	0.013	0.007	0.016	0.114	0.113	0.116

Note: Mean values are presented.

Table 3. Description of the variables and sample statistics.

Variable	Description	Sample	Subs>0	Subs=0	Loans>0	Loans=0
<i>Cost</i>	Costs per ruble of sales	−0.010	−0.005***	−0.015	−0.014	−0.005
	minus average value in the industry in the region	[0.241]	[0.231]	[0.250]	[0.244]	[0.239]
<i>Rsubn</i>	Log of real regional subsidies per worker in the region	3.997 [1.047]	4.010* [1.030]	3.985 [1.066]	4.014*** [1.058]	3.979 [1.035]
<i>Size</i>	Log of ratio of firm's employment to the regional employment	−0.812 [1.370]	−0.381*** [1.345]	−1.268 [1.240]	−0.665*** [1.393]	−0.988 [1.317]
# of obs.		24365	12535	11830	12820	11373

Note: Mean values are given; standard errors are in parentheses. Stars denote statistical significance of the difference in means between groups of firms distributed by the amount of subsidies or loans correspondingly at 1%(***), 5%(**), and 10%(*) significance level.

Table 4. Distribution of number of firms by the amount of subsidy and amount of loan.

Year	Subsidies Ratio: Subs>0/Subs=0	Loans Ratio: Loans>0/Loans=0
1996	373/99	368/98
1997	2222/1199	3883/3193
1998	2290/2593	2361/3243
1999	2273/3176	3142/3108
2000	2121/2274	2796/1731

Table 5. Estimation results.

	hypothesis 1	hypothesis 2	hypothesis 3
Dep.Variable	I(Subs>0)	Subs/Employment	I(Loans>0)
<i>Cost</i>	0.392** [0.178]	0.323 [0.566]	
<i>Cost</i> ²	−0.222** [0.097]	−0.047 [0.500]	
<i>Lag of Cost</i>			−0.735*** [0.225]
<i>d1996</i>	0.758*** [0.193]	2.598*** [0.410]	
<i>d1997</i>	0.837*** [0.082]	1.492*** [0.224]	−0.653*** [0.113]
<i>d1998</i>	0.063 [0.071]	0.656*** [0.179]	−1.098*** [0.095]
<i>d1999</i>	−0.266*** [0.068]	0.190 [0.152]	−0.965*** [0.083]
<i>Rsubn</i>	0.018 [0.042]	−0.004 [0.143]	
<i>Lag of Rsubn</i>			0.109*** [0.047]
<i>Size</i>	0.375*** [0.097]		0.593*** [0.106]
# of observations	7049	17199	6165
# of firms	2146	5778	1813

Note: Standard Errors are in parentheses.

Stars denote statistical significance at 1%(***), 5%(**) and 10%(*) significance level.

Hypotheses 1 and 3 are estimated by conditional logit model with fixed effects.

Kyriazidou (1997) method is used to test Hypothesis 2.

Appendix

Proof of Lemma 1.

Let us suppose the contrast, i.e. $\exists \theta_1, \theta_2 : \theta_1 < \theta_2, \tilde{e}(\theta_1, e_g, e_0) \leq \tilde{e}(\theta_2, e_g, e_0)$.

Then definition of $\tilde{e}(\theta, e_g, e_0)$ implies

$$\begin{aligned} & \begin{cases} \pi(\tilde{e}(\theta_1, e_g, e_0), e_g, e_0) - C(\tilde{e}(\theta_1, e_g), \theta_1) \geq \pi(\tilde{e}(\theta_2, e_g, e_0), e_g, e_0) - C(\tilde{e}(\theta_2, e_g, e_0), \theta_1) \\ \pi(\tilde{e}(\theta_2, e_g, e_0), e_g, e_0) - C(\tilde{e}(\theta_2, e_g), \theta_2) \geq \pi(\tilde{e}(\theta_1, e_g), e_g, e_0) - C(\tilde{e}(\theta_1, e_g, e_0), \theta_2) \end{cases} \\ \Rightarrow & C(\tilde{e}(\theta_1, e_g, e_0), \theta_1) + C(\tilde{e}(\theta_2, e_g, e_0), \theta_2) \leq C(\tilde{e}(\theta_2, e_g, e_0), \theta_1) + C(\tilde{e}(\theta_1, e_g, e_0), \theta_2) \\ \Rightarrow & \frac{\partial (C(e, \theta_1) - C(e, \theta_2))}{\partial e} \leq 0 \\ \Rightarrow & \frac{\partial^2 C(e, \theta)}{\partial e \partial \theta} \geq 0 - \text{contradiction with single crossing conditions.} \text{¥} \end{aligned}$$

Proof of properties of border levels of efficiency.

In proofs we differentiate equations (14), (15), and (20) by e_g , as they are identities by e_g . We also use the fact that $\frac{\partial e_g}{\partial \alpha} < 0$.

1)

$$\frac{\partial \theta_{12}}{\partial \alpha} < 0 \quad (32)$$

Differentiating (14) by e_g and using envelope theorem one gets:

$$\begin{aligned} -\frac{\partial C(e_1^{12}, \theta_{12})}{\partial \theta} \frac{\partial \theta_{12}}{\partial e_g} &= (1-t) \frac{\partial y_2(e_g)}{\partial e} - \frac{\partial C(e_g, \theta_{12})}{\partial e_g} - \frac{\partial C(e_g, \theta_{12})}{\partial \theta} \frac{\partial \theta_{12}}{\partial e_g} \\ \Rightarrow \frac{\partial \theta_{12}}{\partial e_g} &= \frac{(1-t) \frac{\partial y_2(e_g)}{\partial e} - \frac{\partial C(e_g, \theta_{12})}{\partial e}}{\frac{\partial C(e_g, \theta_{12})}{\partial \theta} - \frac{\partial C(e_1^{12}, \theta_{12})}{\partial \theta}} \end{aligned} \quad (33)$$

Thus, $\frac{\partial \theta_{12}}{\partial e_g} > 0$, as both parts of the ratio (33) are negative, what implies that (32) holds.¥

2)

$$\frac{\partial \theta_{24}}{\partial \alpha} \begin{cases} > 0, \text{ for } e_g(\alpha) < e_3^*(\theta_{34}) \\ < 0, \text{ for } e_g(\alpha) > e_3^*(\theta_{34}) \end{cases} \quad (34)$$

Differentiating (15) by e_g and using envelope theorem one gets:

$$\begin{aligned} -\frac{\partial C(e_4^{24}, \theta_{24})}{\partial \theta} \frac{\partial \theta_{24}}{\partial e_g} &= (1-t) \frac{\partial y_2(e_g)}{\partial e} - \frac{\partial C(e_g, \theta_{12})}{\partial \theta} \frac{\partial \theta_{12}}{\partial e_g} \\ \Rightarrow \frac{\partial \theta_{24}}{\partial e_g} &= \frac{(1-t) \frac{\partial y_2(e_g)}{\partial e} - \frac{\partial C(e_g, \theta_{24})}{\partial e}}{\frac{\partial C(e_g, \theta_{24})}{\partial \theta} - \frac{\partial C(e_4^{24}, \theta_{24})}{\partial \theta}} \end{aligned} \quad (35)$$

Therefore, $\frac{\partial \theta_{24}}{\partial \alpha} > 0$ for $e_g < e_3^*(\theta_{34})$ and $\frac{\partial \theta_{24}}{\partial \alpha} < 0$ for $e_g > e_3^*(\theta_{34})$ as denominator of the ratio in (35) is positive and numerator is negative for $e_g > e_3^*(\theta_{34})$, what implies that (34) holds.¥

3)

$$\frac{\partial \theta_{23}}{\partial \alpha} < 0 \quad (36)$$

Differentiating (20) by e_g one gets:

$$\frac{\partial \theta_{23}}{\partial e_g} = \frac{(1-t) \frac{\partial^2 y_2(e_g)}{\partial e^2} - \frac{\partial^2 C(e_g, \theta_{23})}{\partial e^2}}{\frac{\partial^2 C(e_g, \theta_{23})}{\partial e \partial \theta}} \quad (37)$$

Thus, $\frac{\partial \theta_{23}}{\partial e_g} > 0$, as both parts of the ratio (37) are negative, what implies that (36) holds. \forall

Proof of properties of function $B(\alpha)$.

(a) Assumptions about technology infer that there are always firms that are self-repaying, and therefore are financed. Thus, taxes are always positive. Subsidies under no paternalism regime are zero. Consequently, balance of payments under $\alpha = 0$ is positive in period $t = 1$.

(b) Denote the set of efficiency of financed firms in the case of ability to have negative budget at paternalism level α as $\Phi(\alpha)$. It follows from the presented analysis that $\theta \in \Phi(\alpha) \Leftrightarrow \theta \geq \theta_{12}(\alpha)$. Consider the case $\alpha > \alpha^*$. It follows from $\frac{\partial \theta_{12}}{\partial \alpha} < 0$ that $\Phi(\alpha) \supset \Phi(\alpha^*)$. If $\theta \in \Phi(\alpha^*)$ then according to Lemma 2 $\tilde{e}(\theta, e_g(\alpha), e_0) \leq \tilde{e}(\theta, e_g(\alpha^*), e_0)$. Since $B(\alpha^*) = 0$ and $B(0) > 0$, at least some of the firms pay lower taxes in $t = 1$, than the received subsidy. All the firms from the set $\Phi(\alpha^*)$ exert not higher effort under α , than under α^* , and due to Lemma 1 added firms ($\theta \in \Phi(\alpha) \setminus \Phi(\alpha^*)$) exert effort lower than effort of any firm from $\Phi(\alpha^*)$. Consequently, firms from the subset $\Phi(\alpha) \setminus \Phi(\alpha^*)$ pay taxes lower than the subsidies they get, and firms that belong to the set $\Phi(\alpha^*)$ decrease the government's budget in $t = 1$. Thus, $B(\alpha) < 0$ for $\alpha > \alpha^*$.

Formally, $B(\alpha^*) = 0 \Rightarrow y_1(e_g(\alpha^*)) - K < 0$ and for all firms not belonging to $\Phi(\alpha^*)$: $\tilde{e} < e_g(\alpha^*)$. Denote $b(\tilde{e}(\theta, e_g(\alpha), e_0))$ - the difference between taxes paid in period 1 by firm θ and a subsidy given to it. Thus,

$$B(\alpha) = \int_{\theta_{12}(\alpha^*)}^{\infty} (b(\tilde{e}(\theta, e_g(\alpha), e_0))) dF(\theta) + \int_{\theta_{12}(\alpha)}^{\theta_{12}(\alpha^*)} (b(\tilde{e}(\theta, e_g(\alpha), e_0))) dF(\theta) \quad (38)$$

Due to Lemmas 1 and 2, and $B(\alpha^*) = 0$, the first intergral in (38) is negative. It also follows from Lemmas 1 and 2 that the second integral in (38) is negative. Thus, $B(\alpha) < 0$ for $\alpha > \alpha^*$. By analogy one can show that $B_\alpha(\alpha) < 0$ for $\alpha > \alpha^*$. \forall

Proof of Proposition 3.

The proof is carried out in two steps. First, we prove that equilibrium strategies under α^* compose equilibrium under $\alpha > \alpha^*$. Second, we prove that this equilibrium is unique for $\alpha > \alpha^*$.

Step 1. The equilibrium under α^ is an equilibrium under $\alpha > \alpha^*$.* Actually, the government bails out all the firms that are profitable for it, while it meets the liquidity constraint. $B(\alpha) = 0$, as all financed firms exert $\tilde{e}(\theta, e_g(\alpha^*), e_0)$. Thus, the government's strategy is an equilibrium one.

Exerting higher effort any firm will lose. Only firms that under α^* exerted $e_g(\alpha^*)$ would reduce effort, if they were bailed out. But they won't, because deviation of a financed firm to effort lower than $e_g(\alpha^*)$ at $\alpha > \alpha^*$ implies negative balance of payment, if the government subsidize this firm. It also implies that this firm is the least profitable to bail out. Thus, it would not be saved by the government. Consequently, firms strategies are also equilibrium strategies.

It remained to show that the lenders are also rational. The lenders knowing that all the firms $\in \Phi(\alpha^*)$ repay, rationally finance them. They also know that the remained firms would never exert $e \geq e_g(\alpha^*)$, and consequently they do not finance them, as $B(\alpha^*) = 0$, and the government will not bail out firms that exert. It is also not rational to switch financing from some of the financed firms (e.g. one with $b(\tilde{e}(\theta, e_g(\alpha), e_0) < 0)$ to firms with $\theta < \theta_{12}(\alpha^*)$. Actually, all the firms with $\theta \geq \theta_{12}(\alpha^*)$ get offers from at least two lenders in equilibrium under α^* . Therefore, such a switch is not different from simply financing firms with $\theta < \theta_{12}(\alpha^*)$. Thus, the lenders behavior is also equilibrium one.

Step 2. Uniqueness of the equilibrium under $\alpha > \alpha^$.* Assume the opposite, and denote minimal effort exerted by a financed firm as $e_{\min}(\alpha)$. If $e_{\min}(\alpha) > e_g(\alpha^*)$, then all the firms that belong to $\Phi(e_g^{-1}(e_{\min}(\alpha)))$ (and only they) are financed.⁴¹ In this case, the short-term balance of payments of the government is positive and it is profitable to finance a firm $\in \Phi(\alpha^*) \setminus \Phi(e_g^{-1}(e_{\min}(\alpha))) \Rightarrow e_{\min}(\alpha) \leq e_g(\alpha^*)$. If $e_{\min}(\alpha) < e_g(\alpha^*) \Rightarrow$ the budget is negative, as none of the firms $\notin \Phi(\alpha^*)$ exert $e \geq e_g(\alpha^*)$, and consequently all the firms $\in \Phi(\alpha^*)$ exert the same effort as under α^* .⁴² Therefore, it is irrational to lend to firms $\notin \Phi(\alpha^*)$.

Thus, $e_{\min}(\alpha) = e_g(\alpha^*)$. Consequently, all the firms $\notin \Phi(\alpha^*)$ are not financed, and all the firms $\in \Phi(\alpha^*)$ are. Moreover, the equilibrium strategy of all the firms $\in \Phi(\alpha^*)$ is $\tilde{e}(\theta, e_g(\alpha^*), e_0)$. \forall

⁴¹ Single-crossing condition infers that if a firm θ_0 is financed, then any firm with $\theta > \theta_0$ should be financed in the equilibrium, because it will strictly benefit from repaying, and the lenders can get a rent by setting a contract (K_+, K) .

⁴² Firms belonging to $\Phi(\alpha^*)$ do not reduce efforts with growth of α to keep the balance of payment of the government non-negative, and correspondingly to be financed (by analogy to discussion in step 1).